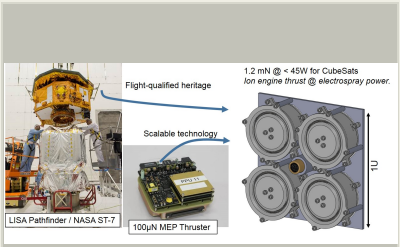
Small Business Innovation Research/Small Business Tech Transfer

1mN Electrospray Thruster with Safe Passive Propellant Delivery, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

Busek proposes to develop a compact electrospray propulsion system with unprecedented capability. The <2U system will provide 6U CubeSats with 1000m/s of deltaV at 1.2mN thrust and >1500s Isp while requiring less than 45W of power. Compared with existing state-of-the-art CubeSat thrusters, the system will provide more thrust than available gridded ion engines at lower power and without greatly penalizing Isp. Busek will develop the thruster through new innovations merged with existing, flight-qualified electrospray thruster heritage. The extremely low flow rates of high Isp electrospray thrusters permits passive feeding, where pressure vessels, regulators and their associated electronics are eliminated in favor of a natural flow regulation; freeing up valuable volume budget for additional propellant or payload. However, passive electrospray thrusters in general suffer from flow control ambiguities, leading to irrecoverable failures due to the conductive propellant degrading or shorting electrical isolators. Busek will integrate new innovations that overcome these issues into a systematic development methodology, leading to the most robust passively-fed electrospray thruster to date. The system will be capable of more 0.7kg of propellant throughput (~1000m/s deltaV for a 6U CubeSat) and be fully scalable to higher capacity.In Phase I Busek will develop a thruster head that provides >300microN of thrust and includes a never-saturated porous reservoir. The restorative capillary force of this reservoir will prevent liquid seepage and maintain consistent performance. An annular geometry will circumvent propellant and surface degradation due to edge effects. In parallel, a method for transferring IL from high open volume storage tanks to the intermediate porous reservoir will be demonstrated. Finally, the complete 1.2mN thruster, comprising an array of 4 thruster heads will be designed. Phase II, will validate this system and culminate with delivering an engineering model



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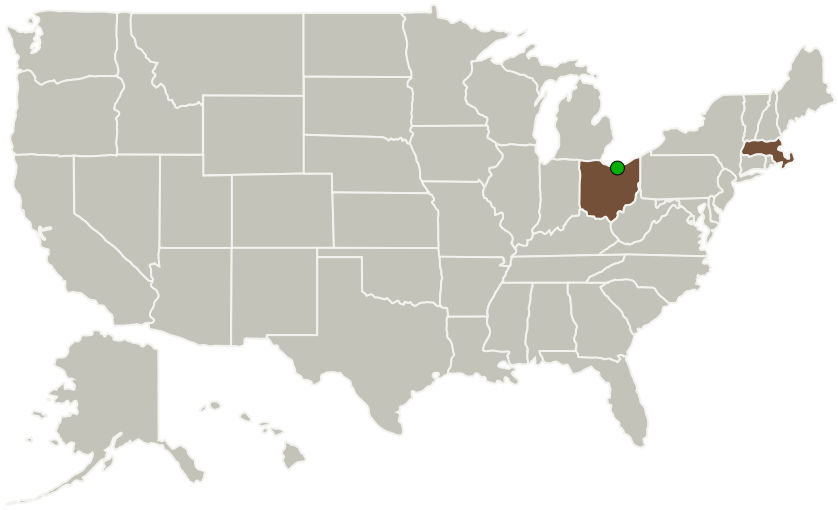
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Busek Company, Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Natick, Massachusetts
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Massachusetts	Ohio

Project Transitions

June 2016: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Busek Company, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

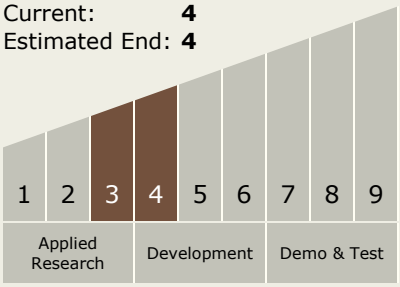
Carlos Torrez

Principal Investigator:

Nathaniel Demmons

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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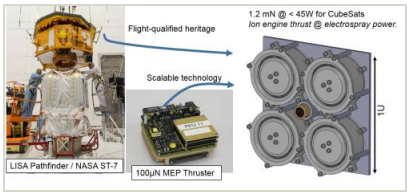
December 2016: Closed out

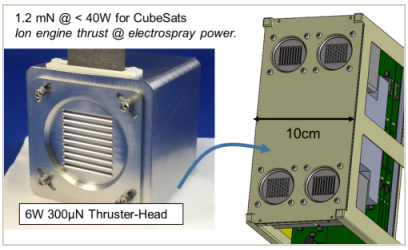
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140472)*

Images



Briefing Chart Image
1mN Electrospray Thruster with Safe Passive Propellant Delivery, Phase I
(https://techport.nasa.gov/image/132767)



Final Summary Chart Image
1mN Electrospray Thruster with Safe Passive Propellant Delivery, Phase I Project Image
(https://techport.nasa.gov/image/135000)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.2 Electrostatic

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System